David M. Higdon

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Education

Ph.D.,	August 1994, Statistics, University of Washington
M.A.,	1989, Mathematics, University of California at San Diego
B.A.,	1987, Mathematics, University of California at San Diego

Dissertation

Bayesian inference for spatial data, incorporating model uncertainty. Applications are in binary classification, agricultural field trials and compositional data.
Advisor: Julian Besag

Research Interests

space-time modeling; modeling non-standard dependence structure; inverse problems in hydrology and imaging; inference based on combining deterministic and stochastic models; multiscale models; parallel processing in posterior exploration; statistical modeling in ecology, environmental science, and biology; statistical computing; Monte Carlo and simmulation based methods; statistical consulting

Professional Experience

2005-present	Group Leader, Statistical Sciences Group (D-1) Los Alamos National Laboratory, Los Alamos, NM.
2001-2005	Technical Staff, Statistical Sciences Group (D-1) Los Alamos National Laboratory, Los Alamos, NM.
1996-2001	Assistant Professor at the Institute of Statistics and Decision Sciences; Coordinator, Statistical Consulting Center; Director of the Center for Multiscale Modeling and Distritributed Computing. Duke University, Durham NC.
1995-1996 & 1999-2001	Research Associate, National Institute of Statistical Sciences, Research Triangle Park, NC.
1994-1996	Visiting Assistant Professor at the Institute of Statistics and Decision Sciences; Coordinator, Statistical Consulting Center. Duke University in Durham NC.
1992-93	Programmer. StatSci Inc., Seattle WA.
1991	Instructor, University of Washington Extension (summer).
1990-94	Teaching and research assistant. Statistics Department, University of Washington.
1989-90	Mathematician/Analyst for B. K. Dynamics in San Diego. Designed and coded projection and simulation models; designed and maintained large databases on a mainframe and personal computers.
1989-90	Adjunct Professor, Miramar Community College, San Diego.

Courses Taught

Undergarduate	College Algebra, Business math, business statistics, statistics for the social sciences, introductory statistics, statistics for the biological sciences.
Graduate	advanced probability models, spatial modeling, stochastic modeling, Markov chain Monte Carlo based approaches for inverse problems, statistical consulting workshop, data analysis for the environmental and biological sciences.

Manuscripts

Heitmann, K., Higdon, D., Nakhleh, C. and Habib, S. (2006). Cosmic Calibration. To appear in *Astrophysical Journal Letters*.

Williams, B., Higdon, D., Moore, L., McKay, M. and Keller-McNulty S. (2006). Combining Experimental Data and Computer Simulations, with an Application to Flyer Plate Experiments, to appear in *Bayesian Analysis*.

Linkletter, C., Bingham, D., Hengartner, N., Higdon, D., and Ye, K. (2006). Variable selection for Gaussian process models in computer experiments. To appear in *Technometrics*.

Higdon, D. (2006). A Primer on space-time modelling from a Bayesian perspective. To appear in *Statistics of Spatio-Temporal Systems* (B. Finkenstadt and L. Held, eds), Chapman & Hall/CRC.

Christie, M. A., Glimm, J., Grove, J., Higdon, D., Sharp, D. H. and Wood-Schultz, M. M. (2005). Error Analysis and Simulations of Complex Phenomena. *Los Alamos Science*, 29, 6–25.

Lee, H., Higdon, D., Calder, K. and Holloman, C. (2005). Spatial Models via Convolutions of Intrinsic Processes. *Statistical Modelling*, 5, 1–21.

Lee, H., Sanso, B, Zhou, W and Higdon, D. (2005). Inferring Particle Distribution in a Proton Accelerator Experiment. *Bayesian Analysis*

Higdon, D., Kennedy, M., Cavendish, J., Cafeo, J. and Ryne R. D. (2004) Combining field observations and simulations for calibration and prediction. *SIAM Journal of Scientific Computing*, 26, 448–466.

Higdon, D., Williams, B., Moore, L., McKay, M. and Keller-McNulty S. (2004). Uncertainty Quantification for Combining Experimental Data and Computer Simulations, in *Society for Modeling and Simulation International*, D. Pace and S. Stevenson eds.

Nakhleh, C. and Higdon, D. (2004). Discussion of: When Can Finite Testing Ensure Infinite Trustworthiness? *Journal of the Iranian Statistical Society*, 3, 30–34.

Higdon, D. (2004). Discussion of: Nonstationary Multivariate Process Modeling through Spatially Varying coregionalization. *Test*, 13, 298–303.

Higdon D., Lee, H. and Holloman, C. (2003). Markov chain Monte Carlo-based approaches for inference in computationally intensive inverse problems (with discussion) *Bayesian Statistics 7. Proceedings of the Seventh Valencia International Meeting*, 181–197.

Ferreira, M., West, M., Lee, H. K., Higdon D. and Bi, Z. (2003). Multi-scale Modelling of 1-D Permeability Fields *Bayesian Statistics 7. Proceedings of the Seventh Valencia International Meeting*, 181–197.

Bayarri, M.J., Berger, J.O., Higdon, D., Kennedy, M.C., Kottas, A., Paulo, R., Sacks, J., Cafeo, J.A., Cavendish, J., and Tu, J. (2002). A framework for the validation of computer models. *Society for Modeling and Simulation International*, D. Pace and S. Stevenson eds.

Higdon D. (2002). Space and space-time modeling using process convolutions, in *Quantitative Methods for Current Environmental Issues* (C. Anderson, et al. eds), 37–54, Springer, London.

C. A. Calder, C. Holloman, D. Higdon (2002) Exploring Space-Time Structure in Ozone Concentration Using a Dynamic Process Convolution Model. *Bayesian Case Studies VI* (Kass et al. eds.). 165–176. Springer, New York.

Higdon D., Lee, H. and Bi, X. (2002). A Bayesian Approach to Characterizing Uncertainty in Inverse Problems Using Coarse and Fine Scale Information. *IEEE Transactions in Signal Processing.* **50**, 389–399.

Lee, H., Higdon, D., Bi, Z., Ferreira, M., and West, M. (2002). Markov random field models for high-dimensional parameters in simulations of fluid flow in porous media. *Technometrics* **44**, 230–241.

Lee, Malallah, Datta-Gupta and Higdon (2002). Multiscale Data Integration using Markov random fields. To appear in *Society of Petroleum Engineers Journal.*

Higdon, D. M. and Yamamoto, S. Y. (2001), Bayesian Image Analysis in Scanning Magnetoresistance Microscopy, *Journal of the American Statistical Association* **96**, 785–793.

Higdon, D. (2001), Discussion of: The art of data augmentation, by D. vanDyk and X. L. Meng. *Journal of Computational and Graphical Statistics.*

Higdon, D. (2000), Discussion of: A Bayesian time-course model for functional magnetic resonance imaging data, by C. R. Genovese, *Journal of the American Statistical Association*, **95**, 705–706.

Borsuk, M., Higdon, D., and Stow C. (2000). A Bayesian hierarchical model to predict benthic oxygen demand from organic matter loading in estuaries and coastal zones. *Ecological Modelling.*

Higdon, D. M. and Bowsher, J. E. (2000), Bayesian inference and Markov chain Monte Carlo in imaging. *Image Processing, Proceedings of SPIE*, vol 3661, 1–13.

Kern J. and Higdon, D. M. (1999), A Distance Metric to Account for Edge Effects in Spatial Data Analysis. *Proceedings of the American Statistical Association.*

Higdon, D. M., Swall, J. and Kern, J. (1999), Non-Stationary Spatial Modeling, *Bayesian Statistics 6. Proceedings of the Sixth Valencia International Meeting*, 761–768.

Besag, J. E. and Higdon, D. M. (1999), Bayesian analysis of agricultural field experiments. (with Discussion) *J. R. Statis. Soc. B*, **61**, 691–746.

Higdon, D. M. (1998), Estimation of Genetic Effects in the Presence of Spatial Trend and Censoring, *Proceedings of the 13th International Workshop on Statistical Modeling*, ed. B. Marx.

Higdon, D. M. (1998), A Process-Convolution Approach to Modeling Temperatures in the North Atlantic Ocean, *Journal of Ecological and Environmental Statistics*, **5**,173–190.

Higdon, D. M. (1998), Auxiliary variable methods for Markov chain Monte Carlo with applications, *Journal of the American Statistical Association*, **93**, 585-595.

Kay, R., Madden, H., Van Schaik, C. and Higdon, D.(1998), Primate species richness is determined by plant productivity: implications for conservation. *Proceedings of the National Academy of Science (USA).*

Higdon, D. M. (1997), A Process-Convolution Approach for Spatial Modeling, *Computer Science and Statistics: Proceedings of the 29th Symposium Interface*, ed. D. Scott.

Higdon, D. M., Bowsher, J. E., Johnson, V. E., Turkington, T. G., Gilland, D. R. and Jaszczak, R. J. (1997), Fully Bayesian Estimation of Gibbs Hyperparameters for Emission Computed Tomography Data, *IEEE Transactions in Medical Imaging*, **16**, 516–526.

de Moor, C. A., Higdon D. M., Hilsenbeck, S. G., Clark, G. M. and von Hoff, D. D. (1995), Incorporating toxicity grade information in the continual reassessment method, Discussion paper, ISDS, Duke University.

Besag, J. E., Higdon, D. M. and Mengersen K. (1995), Meta-analysis via Markov chain Monte Carlo: combining information through Bayesian random effects logistic regression, Discussion paper, ISDS, Duke University.

Besag, J., P. J. Green, D. Higdon, and K. Mengersen (1995), Bayesian computation and stochastic systems (with Discussion), *Statistical Science*, **10**, 3-66.

Higdon, D. M. (1993), Contribution: Spatial statistics and Bayesian computation (with Discussion), by J. Besag and P. J. Green. *Journal of the Royal Statistical Society, Series B,* **55,** 25-37.

Besag, J. E. and Higdon, D. M. (1993), Bayesian inference for agricultural field experiments. *Bull. Int. Statist. Inst.,* **55,** no.1, 121-136.

Other Activities

- Invited Speaker, Joint Statistical Meetings, Seattle WA, 2006.
- Invited Speaker, Valencia 8, Benidorm, Spain, 2006.
- IMS Program Chair (contributed talks), Joint Statistical Meetings 2005.
- Invited Speaker, COBAL 2, San Juan de Los Cabos, Mexico, 2005.
- Invited Presenter at SEMSTAT '04, Munich Germany, 2004.
- The Invited Presenter at the Summer Institute in Statistics, Brigham Young University, Provo UT, 2004.
- Program Chair, WNAR 04, Albuquerque NM, 2004.
- Invited Speaker, Workshop on Statistical Computer Model Evaluation, Banf, Canada, 2004.
- Invited Speaker, ISBA World Meeting 7, Viña del Mar, Chile, 2004.
- Short Course in Spatial Modeling at RAND, Santa Monica, CA, 2003.
- Invited Speaker, SAMSI Workshop on Multiscale Modeling, RTP, NC, 2003.
- Invited Speaker, IPAM Inverse Problem Workshop, Lake Arrowhead, CA, 2003.
- Invited Speaker, Statistical Society of Canada Meeting, Halifax, NS, 2003.
- Invited Speaker, IMS/WNAR Regional Meeting, Golden, CO, 2003.
- Invited Speaker, Joint Statistical Meetings, San Francisco, CA, 2003.
- Invited Speaker, Workshop on Bayesian Analysis, Santa Cruz, CA, 2003.
- Conference Organizer; Seventh Workshop on Case Studies in Bayesian Statistics Pittsburgh, Pennsylvania, September, 2003
- Invited Speaker, 1st Latin American Meeting on Bayesain Statistics (COBOL I) Ubatuba, Brazil February, 2002
- Guest Associate Editor for Statistical Modelling.
- Invited Speaker; IMS/ENAR Spring Regional Meeting Washington D.C., 2002.
- Invited Speaker; 7th Valencia International Meeting on Bayesian Statistics, Tenerife, Spain, 2002.
- Invited Speaker; IMS/WNAR Regional Meeting, Los Angeles, CA, 2002.
- Invited Speaker; IMS/ENAR Spring Regional Meeting Charlotte, North Carolina March, 2001
- Conference Organizer: Second Workshop on Bayesian Inference In Stochastic Processes Villa Monastero, Varenna (LC), Italy May-June, 2001
- Workshop Organizer and Invited Speaker, Workshop on spatial moving average models, Seattle WA, July 2001
- Conference Organizer; Sixth Workshop on Case Studies in Bayesian Statistics Pittsburgh, Pennsylvania, September, 2001
- Invited Speaker, TIES 2001 Conference Portland, Oregon August, 2001

- Invited talk at TIES/SPRUCE (The International Environmetrics Society and Statistics in Public Resources and Utilities, and in Care of the Environment) International Conference. Sheffield UK, September 2000.
- Invited discussant of the JASA case study session, Joint Statistical Meetings, Indianapolis IN, Aug 2000.
- Invited speaker at the Workshop on Statistics for Large Datasets, NCAR, Boulder CO, July 2000.
- Invited Speaker, Workshop on Hierarchical Modeling in Environmental Statistics Ohio State University, Columbus, OH May 2000
- Invited speaker at Biometrics Society Meeting, Eastern North America Region, Chicago IL, March 2000.
- Invited talk at the Joint Statistical Meetings, Baltimore MD, August 1999
- Invited speaker at Lukac's Symposium on the Environment, Bowling Green OH, April 1999
- Keynote Address at the SPIE (International Society for Optical Engineering) meeting on Medical Imaging, San Diego Winter 1999.
- Read Paper before the Royal Statistical Society, London, Fall 1998.
- Invited talk at the Meeting on Stochastic Processes, Madrid, Spain, Spring 1998.
- Invited paper at Interface 97, Houston TX, Spring 1997.

Grant Awards

Robustness and scale in spatial applications of Markov chain Monte Carlo for Bayesian inference. PI. National Science Foundation Grant DMS-9505114 ($40,000).

Non-stationary models for spatial statistics and Bayesian image analysis. PI. National Science Foundation Grant DMS-9704425 ($141,000).

Multiscale Modeling and Simulation in Scientific Inference: Hierarchical Methods for Parameter Estimation in Porous Flow. Co-PI with John Trangenstein (Math) and Zibigniew Kabala (Civil and Environmental Engineering) National Science Foundation Grant DMS-9873275 ($2,300,000).

Framework for Statistical Evaluation of Complex Computer Models. Co-PI with Alan Karr (National Institute of Statistical Sciences), Jim Berger and Jerry Sacks (ISDS, Duke University), and Susie Bayarri (Universitat de Valencia), National Science Foundation Grant DMS-0073952 ($900,000).

Spatial-Temporal Models for Health Effects. Co-PI with Merlise Clyde (ISDS, Duke University) and Robert Wolpert (ISDS, Duke University). Environmental Protection Agency Grant, 2000–2003 ($558,000).

Statistical Methodology for Spatial Modeling and Interpolation of Air and Deposition Pollutants. Co-PI with Montserrat Fuentes (Statistics, North Carolina State University). Environmental Protection Agency Statistical COOP 2000–2003 ($500,000).

Multiscale Modeling and Parameter Estimation. PI. Los Alamos National Laboratory LDRD-ER 2001–2003.

Distributed Markov Chain Monte Carlo for Inverse Problems. PI. Los Alamos National Laboratory LDRD-ER 2002–2005.

Carbon Sequestration. Co-PI with Don Zhang and others. Los Alamos National Laboratory LDRD-DR 2003–2006.

Dissertations Supervised

Jenise Swall (1999) *Non-stationary spatial modeling using a process convolution approach.*
John Kern (2000) *Bayesian Process-Convolution Approaches to Specifying Spatial Dependence Structure.*
Chris Holloman (2002) *Parameter Estimation Algorithms for Computationally Intensive Spatial Problems*
Catherine Calder (2003) *Exploring Latent Structure in Spatial Temporal Processes Using Process Convolutions*